

Beyond Hype, Hyperbole, Myths, and Paradoxes: Scaling Up Participatory Learning and Assessment in a Big Open Online Course

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Most readers of this volume are likely familiar with the distinctive history of massive open online courses (MOOCs). Their rapid expansion contrasts with the more steady expansion of higher-education technologies in prior decades, punctuated by small bursts around the advent of computers, personal computers, multimedia computers, and the Internet. The pace of change quickened around the turn of the century with the open education movement that laid some groundwork for the modern MOOC. The acronym itself was coined in 2008 for an open course on “connectivist” learning offered by George Siemens and Stephen Downes. MOOCs exploded in 2011–12 with Udacity, Coursera, edX, and others, suddenly enrolling tens of thousands of students around the world in free courses designed around the instruction of prominent academics. This outpouring of attention, investment, and learners was unprecedented in higher education.

Even as the *New York Times* dubbed 2012 “The Year of the MOOC” (Papano 2012), the backlash against MOOCs was already underway. Many observed that the streaming videos and quizzes that dominated the newer MOOCs represented relatively shallow ways of interacting with content (e.g., Kays 2012; Marks 2012; Pope 2012). The acronym “xMOOC” (variously for eXtended or eXtension) was introduced to distinguish these newer offerings from the earlier networked and interactive courses advanced by Siemens and Downes, which quickly came to be called “cMOOCs” in response. Some observers had already commented on the difficulty of connecting with other learners in the cMOOCs (Mackness, Mack, and Williams 2010). It turned out that supporting social interaction in the xMOOCs was proving *much* harder. An effort to include more interaction and group projects in a Coursera course on online learning was widely cited for going “laughably awry”

(Oremus 2013, 1). A study found that engagement in Coursera discussion forums declined significantly over time among completers, and that instructor involvement actually worsened participation (Brinton et al. 2014). While the “hype and hyperbole” over MOOCs continued to pour forth (Billsberry 2013, 739), John Daniel, an influential leader in the open-learning movement, captured the widespread concerns by summarizing the “myths and paradoxes” of xMOOCs (Daniel 2012). These included *number* of students taught (but single-digit completion rates), *value* (dubious certificates of completion), *purpose* (disregard for outcomes and focus on posturing and profits rather than spreading learning), *pedagogy* (essentially behaviorism), *access* (mostly serving elites), and *risks* (MOOCs as degree mills).

Yet the rapid expansion of MOOCs also prompted significant scholarly consideration of “learning at scale.” In 2013, the National Science Foundation organized workshops on the topic (Fisher and Fox 2013), while the Bill and Melinda Gates Foundation established the MOOC Research Initiative that supported in-depth investigations for over twenty courses (Gasevic et al. 2014). In 2014, the Association for Computing Machinery initiated the annual Learning@Scale conference, and the number of empirical studies of MOOCs grew rapidly (e.g., Ebben and Murphy 2014; Papamitsiou and Economides 2014). As nicely detailed in the other eighteen chapters in this volume, innovators began pushing the boundaries of the xMOOC platforms and created new cMOOC formats, resulting in many promising formats to support more ambitious forms of learning at scale.

This chapter summarizes one ongoing effort that is intended to inform the entire range of efforts to scale open learning. Like others in this volume, we aimed to move beyond the current rhetoric of MOOCs. More specifically, this effort is part of a broader program of research that is attempting to transcend a forty-year-old debate over instructionist versus constructivist approaches to instruction. Instructionist approaches are rooted in a more “associationist” perspective on learning (e.g., Anderson 1990; Gagné 1985) which assumes that higher order knowledge can and should be broken down into smaller elements that can be individually learned, mastered, and assessed.¹ This perspective is explicitly manifested in artificially intelligent tutors, like those associated with Carnegie Mellon University (Koedinger and Corbett 2006) and competency-based education (Bramante and Colby 2012) and

1. Many scholars distinguish between older behaviorist variants and newer cognitivist variants. The former assumes knowledge is represented by behavioral stimulus-response associations, whereas the latter assumes knowledge consists of cognitive associations; both share this same reductionist assumption that makes them largely antithetical to constructivism.

more implicitly manifested in the xMOOCs. The obvious advantage of associationist approaches is that they make little or no demand on instructors, and scale readily. In contrast, constructivist approaches are rooted in more “rationalist” views of learning (e.g., Glaser 1984) that emphasize the construction of higher-level conceptual schema that learners create to make sense of the world (rather than by assembling numerous smaller associations). While there are many variants, constructivist approaches are more open-ended and inquiry-oriented than instructionist approaches. This means that these approaches can support plenty of engagement around more fundamental disciplinary concepts and meaningful social engagement around those concepts. But doing so requires patient instructors with sufficient understanding of both the particular discipline and how knowledge develops in the discipline—the so-called PCK, or pedagogical content knowledge, popularized by Lee Shulman in the 1980s (Shulman 1986).

Constructivist approaches such as problem-based learning have been explored extensively in conventional online contexts (e.g., Kanuka and Anderson 2007). However, as exemplified by the case of the Coursera meltdown mentioned above, constructivist approaches can be very difficult to scale. This is because both the people who design a course and then the instructors and facilitators who teach that course need a lot of TPCK (technological pedagogical content knowledge; Koehler and Mishra 2008) concerning the way that disciplinary knowledge can optimally unfold *within the particular technology*. In many settings this knowledge will be in very short supply, very expensive, or both. The challenge of scaling constructivist learning becomes particularly apparent when it comes to assessing student learning; even knowledgeable instructors are hard pressed to evaluate learner-generated artifacts or student performance efficiently and reliably, and most constructivist assessment practices are exceedingly difficult to automate with computers. Furthermore, assessing constructivist learning with the multiple-choice and short-answer formats associated with instructionist approaches are likely to miss the most important outcomes. For these reasons, the tensions that follow from antithetical assumptions behind constructivist and instructionist approaches are certainly exacerbated in most efforts to scale learning.

The new course described in this chapter attempted to transcend these tensions and produce new practices for scaling learning by drawing on two related sets of contemporary insights. The first are newer “participatory” approaches that can harness the advantages and minimize the disadvantages of both instructionist and constructivist approaches. The new course described in this chapter emerged from prior efforts to create this kind of synthesis in conventional online courses focusing on conventional course content.

The second set of insights comes from learning theorists including Siemens, who set out to exploit the unique nature of digital knowledge networks and interest-driven social networking.

Participatory Learning and Assessment (PLA)

The design of this new course was rooted in an extended program of design-based research of educational multimedia (e.g., Hickey, Taasooobshirazi, and Cross 2012; Hickey and Zuiker 2012), educational video games (e.g., Barab et. al. 2007; Hickey, Ingram-Goble, and Jameson 2009), and secondary language arts instruction (Hickey, McWilliams, and Honeyford 2011). These studies used newer “situative” theories of knowing and learning (Brown, Collins, and Duguid 1989; Lave and Wenger 1991) to uncover new solutions to enduring challenges concerning assessment, feedback, grading, and accountability in technology-rich learning environments. What distinguishes situative theories from the prior theories is that they assume that knowledge primarily resides in the social and cultural practices of knowledgeable humans. This means that learning occurs when humans participate meaningfully in those practices (hence the label “participatory”). Contrary to some characterizations (e.g., Anderson, Reder, and Simon 1996), situative theories do not deny individual knowledge or ignore individual learning. Rather, situative theories assume that individual knowing and learning are “special cases” (i.e., secondary representations) of, primarily, social learning, and that the social, cultural, and technological contexts where knowledge is learned and used is a fundamental aspect of the individual knowledge (Greeno 1998). These assumptions lead to a much broader view of “learning” than the individually oriented instructionist or constructivist perspectives. In addition to the more familiar acquisition of knowledge and skills by individuals, situative theories see learning in moment-to-moment interactions (between learners, materials, and other learners), evolving practices within a cohort of learners (such as a new pattern of interaction in a particular discussion forum), and even broader long-term cultural shifts (such as the way that universities are learning to accommodate MOOCs).

Rather than attempting to prove or demonstrate the situated nature of learning, the prior design studies insistently searched for new approaches to assessing learning given these core situative assumptions about learning. For example, these studies embraced a much broader view of “assessment” that saw assessment taking place wherever learning (broadly construed) was occurring. This in turn pushed aside the conventional distinction between formative assessment (in support of new learning) and summative assessment

(of prior learning), leading to focus on the actual functions of assessment (intended *and* unintended) rather than just the intended summative or formative purposes. The assessment framework that emerged from these studies was used to “align” learning across (a) informal socially interactive activities, (b) semiformal classroom assessments, and (c) formal achievement tests. As illustrated below, this alignment is accomplished by “balancing” the formative and summative functions of assessment within each of these “levels.” These several multiyear design studies resulted in a number of instruction-assessment “ecosystems” that supported remarkable levels of individual and social engagement with course knowledge. Most importantly, the inclusion of high-quality classroom assessments and rigorous achievement tests showed that such engagement could consistently influence the knowledge of individuals and the achievement of groups without ever “teaching to the test.”

The prior program of research referenced above expanded into conventional online courses taught by the first author and others around 2010. The need to organize the findings from the prior research to accomplish this expansion resulted in a general set of design principles. Reflecting a continued focus on participation in sociocultural practices, the larger framework that these principles formed was deemed Participatory Learning and Assessment (PLA). Course features for enacting these principles in the Sakai learning management system were refined in two online graduate-level education courses over several years (Hickey and Rehak 2013). The strategies for organizing the way that students interacted with course content, one another, and the instructor drew significant inspiration from three strands of research that extended situative theories of learning into the era of digital knowledge networks. Two of these were Henry Jenkins’s (2009) notion of online “participatory culture” and studies by Ito et al. (2009) of the way young people “geek out” in interest-driven social networks. While both courses involved conventional textbooks, external open educational resources were gradually incorporated over time. Drawing from the notions of connectivist learning advanced by Siemens (2005) and by Downes (2006), the strategies that emerged for supporting disciplinary interactions with those resources emphasized acknowledging a diversity of opinions, making connections within and between disciplines and networks, and identifying current learning resources.

What distinguishes the PLA framework that emerged from these two courses were online strategies for delivering useful evidence that could be used to enhance participation, individual knowledge, and group achievement, without undermining any of them, and without compromising that evidence for making claims about the resulting knowledge or achievement. The next section describes how this framework was used to scale up one of these two

courses, Assessment in Schools. The approach to this scaling reflected the concern that the rapid scaling of the xMOOCs had “locked in” the narrow instructional approach with which they started. Hence the new course was capped at five hundred learners to allow the gradual development of more interactive features. This big (rather than massive) course was deemed a “BOOC” and the course was called the Assessment BOOC.

Research and Development Context

After developing the Course Builder platform for a course titled Power Searching with Google, Google released an open-source version and began promoting it for wide usage. The course and consequently the platform featured streaming videos and quizzes, much like the xMOOCs. In contrast to more comprehensive learning management systems, Course Builder was designed to support individual courses and to be easily modifiable.² Presumably reflecting concerns about limited interactivity in most MOOCs, Google offered grants to faculty for developing MOOCs that were “more interactive than typical MOOCs.” The first author was awarded one of these grants. With university consent, a small team was assembled to develop and promote the Assessment BOOC.

This new course was first delivered as a twelve-week open course offered to the first cohort of students in fall 2013. It was promoted widely using Google and Facebook and 460 people eventually registered. The first assignment was completed by 160 participants, and 60 ultimately completed the course, including 8 students enrolled in a three-credit, graduate-level section. The Assessment BOOC was taught a second time in summer 2014, when some of the new features were automated, and streaming videos and open-ended self-assessments were added. Because most of the energy in 2014 was committed to recording videos and automating features, the course was not as widely promoted, and the instructor and teaching assistant had very limited interaction with individual students. Of the 187 registrants, 76 completed the first assignment and 22 completed the course, including 12 credential students. The course was then refined to allow a self-paced version to be offered in 2015, with little or no direct instructor involvement for the open students.

The following discussion of the BOOC course features is organized around the five PLA design principles. The extensive evidence of student engagement

2. Whereas the Open edX platform consists of approximately five hundred thousand lines of code, Course Builder consists of just five thousand lines; the effort described here ultimately added about three thousand additional lines, mostly in the form of course content.

and learning left behind in both courses is currently being analyzed. Some of this evidence of engagement and learning in both courses, as well as details of how each feature was scaled, has already emerged from the peer review process (Hickey, Quick, and Shen 2015). This chapter focuses on how these features embodied the five PLA principles and introduces new theoretical refinements regarding the different kinds of interaction associated with each.

PLA Design Principles, Course Design, and Course Features

The five PLA design principles coordinate activity across different kinds of interactions that support different kinds of learning. Drawing on Hall and Rubin's (1989) study of situated learning in mathematics classrooms, the principles distinguish between interactions that are *public* (presented to every member of the class and potentially beyond), *local* (in public but between specific peers and/or the instructor), or *private* (between individuals). A fourth kind of interaction, *discreet* (i.e., unobtrusive), was added to highlight the core PLA assumption that conventional achievement tests should be used judiciously and inconspicuously.

The PLA principles and features draw inspiration from Engle and Conant's (2002) notions of *productive disciplinary engagement* (PDE). Engle and Conant pointed out that engagement that is *disciplinary* involves both the declarative knowledge of the discipline as well as the social and cultural practices in which disciplinary experts engage. They further argued that disciplinary engagement that is *productive* generates numerous connections between that declarative knowledge and the learner's experiences engaging in disciplinary practices.

As elaborated in Hickey (2015) and summarized below, the PLA framework essentially embeds Engle and Conant's design principles for fostering PDE within the "multilevel" assessment model that emerged in the earlier design research. Because the course features used to enact the five PLA principles are organized around these principles, some features are not introduced in the order that learners encounter them.

1. USE PUBLIC CONTEXTS TO GIVE MEANING TO KNOWLEDGE TOOLS

The first PLA principle embodies the core situative assumption that the context in which disciplinary knowledge is learned and used is a fundamental part of that knowledge. Students' own prior experience, current interests, and future aspirations are used to publically "problematize" the disciplin-

ary knowledge of the course. This is consistent with Engle and Conant's first design principle: *problematize subject matter from the perspective of the learner*. This leads to course features that are different from the more common inquiry-oriented and problem-based approaches (even when such approaches allow students to choose or generate their own problems).

1.1 Personalized learning contexts. In the Assessment BOOC, registrants were directed through a process that asked them questions about their actual or aspirational role in the education system and helped them draft a curricular aim that embodied their practices in that role to personalize their learning in the course. In this way the registration process highlighted the personalized approach that the course would take. This presumably discouraged registrants who were not serious about taking the course and/or who did not find the approach appealing. The information that a registrant entered was then automatically inserted into his or her wikifolio for the first assignment, in which students would further refine that aim. Each subsequent assignment asked learners to restate and reframe their curricular aim as their understanding of that aim grew alongside their knowledge of assessment.

1.2 Networking groups. Registration information regarding primary academic domain and role was used to organize students into networking groups (manually in 2013 and automatically in 2014). Doing so structured local interactions with both similar and different peers and revealed how course content interacted with domains and roles. For example, when learning about portfolio assessment, math teachers find it difficult to even imagine how they would use portfolio assessment, while many composition teachers realize that they are already doing a version of it. Likewise when learning about the validity of evidence for supporting claims about learning, educators are usually most concerned with the content-related evidence relationship (and the relationship between the content of their curriculum and their content of the assessments). Conversely, administrators are usually more concerned with criterion-related evidence (concerning the score needed on a particular assessment to support a particular decision or conclusion), while researchers and doctoral students are often more concerned with construct-related evidence (concerning psychological constructs like motivation). Discussing these differences turns out to be an efficient way to comprehend nuances that would otherwise be impossibly abstract for many learners.

Most existing MOOCs that assign learners to groups employ a relatively rigid structure to allow for manageable assignments in discussion forums.

The fact that discussion forums were not used for group interaction in the Assessment BOOC allowed for a more fluid approach to group membership. This feature was intended to encourage the formation of *affinity spaces* around common interests. Highlighting their central role in participatory culture, Gee (2004, 67) describes the affinity space as “a place or a set of places where people affiliate with others based primarily on shared activities, interests, and goals, not shared race, class culture, ethnicity, or gender.” Rather than asking to be assigned to a different group, learners simply chose with whom they wish to engage. Like most interest-driven social networks, this allowed leaders to emerge and “lurkers” to observe, resulting in new affinity spaces within and across the primary networking groups. This participatory goal was explicitly supported with a simple feature added to the third assignment in the Assessment BOOC in 2014: students were invited to extend their usernames to project additional memberships (e.g., “librarian” or “unemployed math teacher”) to make it easy to find peers with common interests.

1.3 Public course artifacts. Most MOOC platforms are organized around videos and private engagement with prompts for declarative “known-answer” questions. In contrast, all the BOOC assignments consisted of public (to the class) wikifolios that focused primarily on disciplinary practices. While the wikifolio assignments do involve declarative course knowledge (both directly and indirectly), this knowledge was always presented in the context of disciplinary practices and was never presented in the context of known-answer questions.

The open-field wikis that were refined in the prior online courses (in Sakai) were streamlined in the BOOC. Clicking on each section header reveals or hides the detailed instruction for that section. An edit button reveals a WYSIWYG text-editing window below the instructions. For example, the Performance/Portfolio Assessment assignment includes detailed instructions for specific parts of the assignment. This fairly intensive programming effort simplified the assignments and resulted in a complete artifact, meaningful as a stand-alone page that included both prompts and responses. This feature embodies the assumption that learner-generated artifacts occupy a central role in participatory approaches to learning. In contrast to worksheets and highly structured assignments that students often find arbitrary, abstract, and impersonal, “artifacts” are imbued with personalized meaning and identity. Artifacts that are both public and persistent play a crucial role in the interest-driven social networks that provide much of the inspiration for this instructional approach.

1.4 Relevance ranking. A simple strategy for fostering PDE that had emerged in the prior online courses proved to be remarkably scalable in the BOOC. This strategy has students rank the relevance of elements of disciplinary knowledge or disciplinary resources to their aim and/or role, and then justify that ranking. This serves to problematize the disciplinary knowledge *from the learner's perspective*. In the BOOC, this was initially enacted as an open-field activity, as in the prior course. While the course was underway, the feature was redesigned so that learners simply dragged text boxes to indicate their ordering of personalized relevance. In addition to being much simpler for the students, this allowed output of a spreadsheet that showed the relative ranking for each student, which streamlined the development of the public feedback described below.

Thus, for example, in the Performance/Portfolio Assessment assignment, learners first restate their personalized curricular aim, using their growing understanding of their aim alongside their growing understanding of assessment. They then consider the advantages and disadvantages of the two formats and rank them in order of relevance for their aim and justify that selection. After creating a task for the most relevant format and a scoring rubric, learners engage with the seven criteria for evaluating those tasks by ranking them and providing a rationale for (at minimum) the most relevant and least relevant.

This simple activity is probably the single most important feature of the course for fostering PDE, and one that appears to be infinitely scalable. This is because learners understand the activity immediately and because it can be used to support many types of engagement. A particularly important insight is that even when students lack the experience or understanding to rank something, they must engage with the knowledge to reach that conclusion. This in turn prepares them to quite readily appreciate the rankings and rationales of peers with similar aims.

1.5 Personalized open educational resources (OERs). Several of the BOOC assignments had students rank the relevance of carefully curated OERs and/or search for and share new ones. Connectivist views of learning (Siemens 2005) and the realities of twenty-first-century knowledge networks strongly favor helping students learn to use, locate, annotate, and share OERs. In the BOOC, students posted OER URLs in their wikifolios; the annotated URLs were then automatically placed all together on a separate page, where students could easily review them.

1.6 Streaming instructor videos. The prior course and the 2013 BOOC included two introductory videos. In 2014, the instructional team debated adding videos

for each weekly wikifolio. On the one hand, students like online videos and many expect them. Videos can be viewed while commuting or exercising and provide a more personal connection to the instructor. On the other hand, videos might lead some students not to purchase the text or to engage less with the text and their peers. Videos are time consuming to create, and our participatory perspective raises the additional concern that “lecture” videos decontextualize course knowledge while emphasizing “known-answer” declarative knowledge, subsequently discouraging students from explicitly personalizing their wikifolios.

The team ultimately concluded that streaming videos would allow the instructor to model this personalized engagement expected in each weekly assignment relative to the design of the BOOC and the other courses he taught. The new videos also feature the instructor taking positions that diverged from those in the textbook or providing nuanced insights that reflected his own personalized instruction context of teaching this and other courses for many years. Importantly, the videos thus modeled the *practices* associated with disciplinary engagement rather than reiterating declarative knowledge explicated elsewhere.

2. RECOGNIZE AND REWARD PRODUCTIVE DISCIPLINARY ENGAGEMENT (PDE)

This second principle assumes that productive forms of disciplinary engagement should be highlighted and recognized. This is consistent with Engle and Conant’s second and third PDE design principles: *give students authority over their disciplinary engagement* and *hold students accountable for their disciplinary engagement*. Put differently, the BOOC *provides resources to support PDE* (their fourth principle), and these features support student authority and accountability over that engagement. The following features were designed to motivate PDE in both public and local interactions. While we argue that PDE should be recognized and rewarded, we further argue that the process should be transparent and occur outside any formal evaluation or accountability practices (i.e., grades).

2.1 Peer commenting and discussion. Each BOOC assignment instructed students to post at least one question to their peers and to review and discuss the work of their peers by commenting on one another’s wikifolios. Participants’ different rankings and questions are intended to prompt productive local interactions in threaded comments directly at the bottom of each wikifolio. This feature reflects our assumption that commenting directly on artifacts

is more likely to foster disciplinary discussion than conventional discussion forums. Further, this feature allowed the instructor to introduce more advanced and nuanced concepts in the comments, rather than in the body of the assignment, where it might confuse or overwhelm less-experienced students.

2.2 Public feedback. Within MOOCs and beyond, a great deal of attention is being devoted to “private” learning analytics that give learners individualized guidance and feedback, predict which students are going to succeed, and so on. One of the innovations that was explored extensively in the BOOC was public feedback that highlighted exemplary work and showed aggregated ranking for the class as a whole and for each networking group. Before each weekly deadline, the instructor provided relatively extensive comments to students who posted early (generally the more ambitious and experienced students). These comments would typically address an important issue in the assignment that the other students were likely to encounter as well. But these issues are so nuanced and contextual that including them in the assignment itself would overwhelm the less-experienced learners. A course announcement was posted mentioning the issues and directing others to consult those examples and comments once they started on their own wikifolio. The situative insight here is that the other students would have completed enough of the assignment to have enough context to engage meaningfully with such issues.

After each weekly deadline, the instructor publically summarized how the various networking groups ranked the resources or concepts differently. The later public feedback not only articulated these patterns, but also encouraged learners to engage with students outside of their networking groups to re-examine particular concepts and (ideally) revisit and even revise their own rankings. The feedback also pointed students to wikifolios that explored a concept well, revealed interesting nuances, or asked productive questions. This feedback was expected to both motivate students to be recognized and help students reengage efficiently if they performed poorly on the self-assessment described below.

Postcourse student commentaries confirmed that these features together motivated students to post high-quality work early, and that students found the feedback quite useful. Reflecting our argument about gradual scaling, the ranking information was manually gathered by the instructor in the prior classes and initially by a project intern in the BOOC. The automated ranking feature described above was designed in such a way that the ranking information was exported to a spreadsheet from which graphs could be quickly generated. A central goal for further streamlining this course is automating



FIGURE 1.1. Completed peer endorsement and peer promotion page in the 2014 Assessment BOOC (big open online course).

the manner in which this information is consolidated and displayed, as it is currently one of the most laborious aspects of the course.

2.3 Peer promotion. Peer promotions are central to the functioning of friendship-driven networks (e.g., “likes” in Facebook), and peer-established reputations (e.g., badges in the Stack Overflow Q&A sites) are crucial in interest-driven networks. In the prior online course (Hickey and Rehak 2013), students were instructed (but not required) to promote particularly productive examples or exchanges by posting a comment that started with a distinctive string (“&&&”) and providing a warrant. As shown in figure 1.1, this feature was automated in the BOOC. Each week, students were instructed (but not required) to promote one peer wikifolio for being “exemplary” and provide a justification for the selection. The public feedback would indicate which member of each networking group received the most promotions and link to the promoted wikifolio. The peer promotions were issued alongside the peer endorsements (described below) and were fully automated so that a warrant was required and each student could only issue one peer promotion each week.

2.4 Evidence-rich digital badges. Digital badges are “web-enabled micro-credentials” that contain specific claims and detailed evidence supporting

Assessment Policies Leader

Marina Michael, Elementary School Teacher earned this badge by participating in the Educational Assessment BOOC. The earner of this badge has gained and demonstrated expertise by completing four weekly wikifolio assignment concerning policies in educational assessment. These include standardized testing, appropriate test preparation, evaluation of instruction and teaching, and assessment-based grading. Their work has also been recognized as particularly strong by their peers.

Criteria for issuance

In order to earn this Leadership Badge, the awardee had to first:

- Complete four Wikifolio assignments (linked below)
- Engage with peers in discussion (not linked below, for peer privacy)
- Endorse and promote peers' Wikifolios

While engaging in this activity, the wikifolios created by the awardee were marked as "exemplary" more often than any other individual in their peer professional networking group.

Evidence

As of 2013-12-06 at 17:45 UTC:

Unit 8 - Standardized Testing
Complete!

Endorsements: 4 - Comments: 2

Unit 9 - Test Preparation
Complete!

Endorsements: 5 - Comments: 3

• X 2 Exemplary!

Unit 10 - Evaluation of Instruction and Teaching
Complete!

Endorsements: 5 - Comments: 8

• X 5 Exemplary!


Unit 11 - Assessment-Based Grading
Complete!

Endorsements: 8 - Comments: 6

Exemplary!

Assessment Policies Exam
(open November 25 through December 4) - Complete!

Passed the exam, with at least 80 out of 100%.



The graphic is a circular badge with a grey background. At the top, the word 'LEADER' is written in a white, serif font. Below it is a stylized illustration of a classical building with two columns and a pediment. Inside the building, there is a desk with a lamp and an open book. At the bottom of the badge, the words 'ASSESSMENT POLICIES' are written in a white, serif font.

FIGURE 1.2. Evidence contained in the 2014 Assessment BOOC (big open online course) course completion badge and one module.

those claims. As shown in figure 1.2, BOOC students who completed the wikifolios and the exam for each of the three course modules could earn a corresponding digital badge. The badges were automatically issued to students inside of the course and displayed on their profile pages. When students elected to push a badge out of the course, they could choose to include detailed evidence of their engagement and learning. This included links to their completed wikifolios, number of comments (but not the comments themselves because they could contain student names), number of promotions, rationale for the promotions, and an indication of their performance. Earning all three badges and completing the final exam resulted in an *Assessment Expert* badge that contained the other three badges.

The member of each networking group who earned the most promotions earned a version of each badge that stated *Leader* and clearly indicated that their peers found their work exemplary (see fig. 1.2). In 2014, students who transformed the contents of their wikifolios into a comprehensive term paper that the instructor deemed worthy of sharing with peers earned a customizable badge that linked back to the paper itself and the instructor's comments.

The optional term paper generated extra credit for the credential students and was required to earn a grade of A+ in the course. While six students submitted a paper in 2014, only three were deemed sufficient to earn the badge and/or extra credit.

It is worth noting that this project was well aware of the overly simplistic characterizations of evidence-rich digital badges as “extrinsic incentives.” While space does not permit a detailed elaboration, the project acknowledged that badges could be used (and indeed are being used) as arbitrary rewards for activities that students already find intrinsically motivating. Surely such uses of badges will provide yet another example of this “overjustification effect” that has been shown in hundreds of empirical studies (Deci, Koestner, and Ryan 1999). But doing so overlooks the possibility that (1) the specific claims and detailed evidence in *digital* badges makes them intrinsically meaningful; (2) the circulation of claims and evidence in digital networks makes *open* badges particularly meaningful; and (3) that open digital badges have broader sociocultural consequences for learners and ecosystems (Casilli and Hickey 2016).

3. EVALUATE/GRADE ARTIFACTS THROUGH LOCAL ENDORSEMENTS AND REFLECTIONS

In practice, the first two principles result in extensive written student work. Although desired, this creates a new challenge of evaluating and grading all of these artifacts and interactions. The third PLA principle eschews any formal summative evaluation of the content of public artifacts and local interactions. This principle thus builds on existing assessment research that suggests “no marks” (i.e., ungraded) feedback (Harlen 2007) and cautions against overly detailed scoring rubrics in portfolio and performance assessment (Popham 1999). These prior suggestions were reframed using sociocultural approaches to portfolio assessment (Habib and Wittek 2007) and the notion of “portfolio culture” (Gitomer and Duschl 1995). Rather than laboriously evaluating the artifacts for dubious evidence of enduring knowledge and undermining engagement, two features support local interaction that informally assess completion and engagement.

3.1 Instructor and peer endorsement. Students were instructed (but not required) to endorse the wikifolios of at least three peers for being “complete.” As shown in figure 1.1, wikifolios could be endorsed as complete for just the required parts or including the optional parts as well, and wikifolios showed the names of all the endorsers. The instructions indicated that students who

failed to secure an endorsement could email the teaching assistant, but this almost never happened; while the instructor or a teaching assistant personally reviewed and endorsed the wikifolios of all the credential students, nearly every completed wikifolio earned multiple endorsements. In both BOOCs, students averaged around seven endorsements per week. A systematic review in the over eight hundred wikifolios in the 2013 course confirmed that every peer-endorsed wikifolio was completed.³ This suggested that the public nature of the wikifolios and endorsements helped eliminate the threat of collusion. One serious instance of plagiarism was quickly identified when a noncredential student recognized that her response to the optional activity of summarizing the “big ideas” in the chapter had been cut and pasted by another noncredential student. An automated comparison algorithm subsequently confirmed that this was indeed an isolated incident and that very little content was duplicated content across wikifolios.

3.2 Engagement reflections. One of the optional elements on the wikifolios was writing a reflection that students posted after they had interacted with their peers. This practice and the content of the prompts had been extensively refined in the prior courses. Building on notion of *consequential* engagement introduced by Gresalfi et al. (2009), students were instructed to reflect on their *contextual engagement* (“How suitable was your context for learning this knowledge?”), *collaborative engagement* (“Who else’s work and whose comments helped you learn this new knowledge?”), and *consequential engagement* (“What will you do differently in your context and beyond as a consequence of learning this knowledge?”).

The assumption here is that students who had not engaged productively with the disciplinary knowledge of the course would have a difficult time drafting a coherent and convincing reflection. Analyses of log files in the prior course confirmed that some students returned to their wikifolios and engaged more *after* starting their reflections. In this way the reflections accomplished a situative assessment goal of summatively assessing one kind of learning (prior engagement) while formatively assessing another kind of learning (understanding the relationship between new disciplinary knowledge and one’s disciplinary practices). The ultimate intention of these reflections is rooted in the anthropological notion of *prolepsis* (the way anticipated future events shape present activity). It is expected (but not yet proven) that the anticipation of

3. The only exception was the initial question posted to peers, which was not included in roughly a third of the wikifolios.

having to reflect on these three aspects of engagement will proleptically shape learners' prior engagement accordingly.

In addition to formatively supporting the sort of critical engagement that is largely absent in most MOOCs, these reflections also provide informal summative evidence of that engagement. It turns out that it is very difficult for students to generate coherent responses to these reflection prompts without having engaged accordingly. Students in the prior course and the credential students in the BOOC were awarded full points for posting wikifolio drafts by the deadline and later adding a reasonably coherent reflection. Each wikifolio was worth five points out of a hundred, and students were penalized one point a day for each day they were late to ensure a critical mass of interaction around the weekly deadlines. This grading practice quickly revealed that the rare incoherent reflections were typically associated with incomplete assignments. This made it possible to penalize marginal participation without engaging in the tedious and dubious grading of the content of individual artifacts. In the long term, this seems like a feature that would lend itself well to automation, using a relatively basic automated text analysis routine.

4. ASSESS INDIVIDUAL KNOWLEDGE PRIVATELY

This principle reflects the situative assumption that assessments that efficiently generate valid evidence of enduring knowledge must frame that knowledge in ways that limit the assessment's value for directly supporting *new* learning (as elaborated in Hickey 2015). This further suggests that public and local interactions should not be organized around the static representations of knowledge on formal assessments, and that any formal assessment of knowledge should be carried out privately. But we also assume well-designed "curriculum-oriented" assessments are uniquely suited for evaluating the way course activities were designed and the way individual students enacted those activities. This is because they are "proximal" assessments of the disciplinary knowledge emphasized in the course activities (rather than the more general content of textbook or targeted standards).

4.1 Ungraded open-ended quizzes. In 2014, ungraded quizzes featuring six to eight open-ended assessment items were added to each wikifolio. Students had to enter a response to each item to see the scoring key for the item. These formative assessments were entirely voluntary and students were encouraged to attempt the items from memory. While the system retained student responses, these were not formally evaluated by anyone else. The instructions recommended that students who were unable to answer more than one item

from memory should reengage with their classmates (starting with the public feedback) and the text before taking the module exam.

This is a relatively new feature and it is currently being intensively studied. The relationship between the practice items and exam items, the text of the recommendations, and the content of the public feedback seem particularly important here. It is unclear whether the items should be constructed-response or selected-response (or both), or whether the items should focus on disciplinary practices or declarative knowledge (or both). Another question is whether low-performers are recommended to go back and engage more with their peers or go back and review the text. These features are expected to be particularly important in the self-paced BOOC, where credential seekers may be inclined to hastily post their wikifolios in an effort to race through the course with minimal engagement with the disciplinary practices. The situative assumption here is that a formal assessment (even an ungraded one) cannot really capture the extent to which the declarative knowledge sampled by the assessment became contextualized within each learners' personalized disciplinary practices. A related assumption is that the self-assessment represents a small sample of the declarative knowledge that engaged learners should take away from each assignment.⁴

5. MEASURE AGGREGATED ACHIEVEMENT DISCREETLY

The last PLA principle encourages using externally developed multiple-choice achievement test items for very specific purposes. Such “distal” items are “standards oriented.” As long as the items are not “cherry picked” to tap into topics of the specific curriculum, they can be used to create an achievement test that is largely independent of the way a particular course was designed. As such they are useful (and indeed necessary) for measuring learning within courses, comparing learning across different versions of the same course, and accurately documenting course improvement over time.

By “discreet” this principle means unobtrusive and ephemeral; course assignments should never be directly aligned to achievement tests. In most cases students should only see their overall score. Most importantly, little if

4. This gets at a central concern with prevailing approaches to competency-based education and most MOOCs. Specifically, while on-demand assessments can readily capture declarative knowledge, they can't readily capture (a) knowledge of disciplinary practices, (b) the extent to which declarative knowledge has been connected to disciplinary practices (and therefore, will be subsequently usable), or (c) the entire range of disciplinary knowledge associated with particular competencies. As such, these assessments should be used to sample the declarative knowledge left behind from PDE.

any course time should be devoted to instructing students on how to answer multiple-choice items. This is because doing so yields knowledge that is otherwise useless and compromises the validity of any exam that includes those items or similar items.

5.1 Time-limited multiple-choice exams. The exams in the BOOC were timed multiple-choice exams with items selected from the textbook item bank. Items were selected without regard to whether they had been covered in the course, but rather for being difficult or impossible to look up with the limited time available. Test takers only saw their score, and not the correct answer for each item. We experimented with the badge-related evidence associated with the exams and eventually allowed the students to choose to include (a) their actual score, (b) whether they met criteria, or (c) nothing about the exam in their digital badges. For the students who took the course for credit, exam scores were factored into the final course grade.

Findings, Next Steps, and Conclusions

Perhaps the most important finding across the two Assessment BOOCs is that raw engagement for both the credential students and the noncredit students who completed the course increased substantially. The average number of words per wikifolio increased from 1,398/1,207 for the credential/completers in 2013 to 2,820/1,377 in 2014. This suggests that the substantial decline in the amount of local interactions that individual students had with the instructor and teaching assistants did not undermine motivation to work on their wikifolios. One other difference is that the proportion of comments that reference a specific context of practice dropped from around 50 percent in 2013 to about 25 percent in 2014. This appears to have been caused by a 2014 modification that forced students to post a question to their peers before they could share their wikifolios. Most of the other indicators for the two groups were similar across 2013 and 2014, including average comments per wikifolio (4.2/3.4 versus 5.6/3.0), percentage of comments that were deemed disciplinary (for directly referencing the topic of the assignment, both around 95 percent), and exam scores (all around 80 percent).

We are unaware of any other effort to scale up open learning that resulted in these levels of disciplinary engagement, knowledge, and achievement. As such we concluded that this effort to scale up participatory learning was a success. This scaling effort continued in subsequent efforts to create a self-paced version of the Assessment BOOC for summer 2015 with most of these same features. New features are being developed to fully automate registra-

tion, testing, and badge issuance, help learners find active peers working on particular assignments, and let learners archive completed wikifolios in a manner that tells subsequent students whether they are willing to reengage with them. To the extent that the course can attract a sufficient number of participants, it should be possible to attain a level of individual and social PDE that is unprecedented for a self-paced course.

The apparent success of this effort brings us to several conclusions about scaling learning that we believe generalize to other efforts. The first conclusion is that *scaling should be done gradually*. To quickly scale up to massive numbers of users, most MOOCs and MOOC platforms were forced to sacrifice interaction and personalization; because the code behind them is already so complex, those platforms are now finding it quite challenging to incorporate new features. Our second conclusion is that *scaling should be done iteratively*. Our efforts were directly shaped by newer design-based research methods that emphasize the development of “local” theories in the context of reform efforts (Cobb et al. 2003). Furthermore, we conclude that such iterative refinements should be done within a coherent theoretical framework. Because the core multilevel assessment model behind this work was rooted in situative theories of learning, we were able to draw additional research and theory carried on in that tradition to generate useful theoretical insights and practical solutions. In particular we found the notion of PDE especially helpful, because we were able to evaluate all our design decisions in terms of their presumed or actual impact on the disciplinarity and productivity of learner interactions.

Finally, we conclude that the PLA framework seems generally useful for guiding efforts to scale learning. A key feature of this framework is that disciplinary knowledge is represented in somewhat different ways across each level. This increases the trustworthiness of the evidence at one level for assessing the impact of refinements at the previous level. For example, the engagement reflections provide useful evidence of the extent to which students were connecting disciplinary knowledge and disciplinary practices in their wikifolios. This evidence was clearly used by students to refine their subsequent engagement (and sometimes their prior wikifolio); this evidence was also used by the instructor and designers to fine-tune assignments and features within and across courses. Similarly, given that the private self-assessment was ungraded and most students who posted a wikifolio completed them, we presume that students used this evidence to determine whether they were ready to take the exam.

In summary, we believe the synchronization of the PLA framework with iterative design-based refinement is a promising way of scaling interactive

learning. An ongoing collaboration with a fully online university-run high school is bolstering our confidence that this framework can also “scale out” to large numbers of teachers in conventional online classes. In 2013–14, four English teachers successfully used this approach to create entirely new courses for grades 9–12 using OERs and the newer Canvas learning management system. The new courses were developed as alternatives to individualized “distance education” courses that were being delivered using an antiquated system. When the school was reaccredited in 2014, the evaluators were particularly complimentary toward the new courses and encouraged expanded collaboration. The English courses were offered again in 2014–15, and new teachers developed new courses in history and biology. We are particularly encouraged that some of the extensions to the Canvas learning management systems developed for this work (such as wikifolio commenting) are now being incorporated into the larger learning management system for the hosting university. Certainly much work remains to be done, but quite a bit of progress has been made in this initial effort to scale participatory learning.

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